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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/701,884	12/11/2000	John H Jefferson	124-812	9169

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EXAMINER

QUINTO, KEVIN V

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 08/29/2002

10

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/701,884	JEFFERSON ET AL.	
	Examiner	Art Unit	
	Kevin Quinto	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 July 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-32 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-32 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>9</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

Specification

1. The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

- (a) TITLE OF THE INVENTION.
 - (b) CROSS-REFERENCE TO RELATED APPLICATIONS.
 - (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
 - (d) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC (See 37 CFR 1.52(e)(5) and MPEP 608.05. Computer program listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables having more than 50 pages of text are permitted to be submitted on compact discs.) or
REFERENCE TO A "MICROFICHE APPENDIX" (See MPEP § 608.05(a). "Microfiche Appendices" were accepted by the Office until March 1, 2001.)
 - (e) BACKGROUND OF THE INVENTION.
 - (1) Field of the Invention.
 - (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
 - (f) BRIEF SUMMARY OF THE INVENTION.
 - (g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
 - (h) DETAILED DESCRIPTION OF THE INVENTION.
 - (i) CLAIM OR CLAIMS (commencing on a separate sheet).
 - (j) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
 - (k) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).
2. The examiner requests that the specification be labeled accordingly.

Claim Objections

3. Claim 12 objected to because of the following informalities: the word “provided” is improperly conjugated. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claim 6 is rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for “an elongate region of the first semiconductor in a bottom region of the second semiconductor, that is in a bottom region of the lined groove,” does not reasonably provide enablement for “an elongate region of the first semiconductor in a bottom region of the second semiconductor...or in a bottom region of the groove.” The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. The examiner is only aware of an embodiment where the groove is lined with the second semiconductor with the first semiconductor directly on top of this second semiconductor lining. However the examiner believes that there is no enablement for the limitation where the first semiconductor region is at the very bottom of the groove.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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7. Claims 8 and 12-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

8. Claim 8 states there is “more than one conducting means.” In terms of the structure described in claim 1, the examiner is not certain as to what structure is being claimed in light of the specification. On p.14, lines 18-24, the applicant discloses the use of another quantum wire in the groove. However the applicant also discloses a device with a two dimensional array of quantum wires (On p.14, lines 24-27). It is unclear to the examiner as to what structure is being claimed.

9. Claims 12-14 recite the limitation “the electrode or electrodes” in the second line of each of the claims. There is insufficient antecedent basis for this limitation in the claims.

10. The examiner believes that the “the electrode” being referred to is the “at least one further electrode” described in claims 1 and 10 but is not certain. The “electrodes” being referred to in claim 12 do not appear to be referring to the source and drain electrodes. The “electrodes” appear to be referring to the “at least one further electrode” *and an additional electrode not yet described.*

11. Claims 19-32 are rejected under 35 U.S.C. 112, fourth paragraph, as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

12. The process limitations of claims 19-32 fail to further limit the structure described in claim 1.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 1-7, 9, 10, and 12-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kizuki (USPN 5,679,962) in view of Kim et al. (USPN 6,242,275 B1 and further in view of Chapple-Sokol et al. (USPN 5,612,255) and further in view of Doyle et al. (USPN 6,063,688).

15. In reference to claims 1, 2, and 16-18, Kim et al. (USPN 6,242,275 B1, hereinafter referred to as the "Kim" reference) discloses a similar device. Figure 1D of Kim illustrates a substantially one-dimensional elongate conducting means or a quantum wire structure. There is a first semiconductor (17) which is substantially surrounded by a second semiconductor (18). The elongate conducting means or quantum wire is provided within a groove in the second semiconductor (18). This groove is structured such that both walls of the groove are substantially planar surfaces which are roughly parallel to crystal plane (111) on which the first semiconductor (17) is substantially zero. The first semiconductor (17) of Kim is GaAs (gallium arsenide) while the second semiconductor (18) is AlGaAs (aluminum gallium arsenide). The applicant has disclosed that GaAs has a slow growth rate on a (111) plane of AlGaAs (p.12, specification). Kim discloses that the second semiconductor or AlGaAs (18) is grown in the groove (or an intersection of two walls) which is etched in the (111) plane orientation (column 3, lines 7-9). The examiner believes that the AlGaAs (18) is also in the (111) plane and thus meets

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this limitation of the claim. Kim does not explicitly disclose the use of the quantum wire in a transistor structure. However this particular usage for a quantum wire is well known in the art. Chapple-Sokol et al. (USPN 5,612,255, hereinafter referred to as the “Chapple-Sokol” reference) discloses that quantum wire channels have high electron mobility (column 3, lines 10-16). It is also well known in the art that high electron mobility for a transistor channel is desired. Doyle et al. (USPN 6,063,688, hereinafter referred to as the “Doyle” reference) discloses that quantum wire channels have increased electron mobility which leads to a higher drain saturation current thereby increasing chip speeds (column 10, lines 65-67, and column 11, lines 1-7). Kizuki (USPN 5,679,962) discloses a prior art single electron transistor which has a one-dimensional channel (labeled “Quasi – 1DEG”) in figures 17(a) and 17(b). In view of Chapple-Sokol and Doyle, it would be obvious to use the quantum wire of Kim as the channel of Kizuki so as to attain a device with a high electron mobility. The single electron transistor of Kizuki constructed in view of Kim, Chapple-Sokol, and Doyle, has a channel formed of a quantum wire which extends between source and drain electrodes (figures 17(a) and 17(b) of Kizuki). There is at least one further electrode (the electrode labeled “Gate 1” in figures 17(a) and 17(b) of Kizuki).

16. In reference to claim 3, figure 1D of Kim shows that the first semiconductor (17) is provided in the groove or the intersection of two walls.

17. In reference to claim 4, figure 1D of Kim shows that the second semiconductor (18) is formed in a groove which is itself formed in a substrate (14). The second semiconductor (18) lines the sides of the groove.

18. In reference to claim 5, Kim discloses that the first semiconductor (17) and the substrate (14) are made of GaAs (column 3, lines 5-15).

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19. So far as understood in claim 6, figure 1D of Kim shows that an elongate region of the first semiconductor (17) is in a bottom region of a groove lined with the second semiconductor (18).

20. In reference to claim 7, the transistor of Kizuki constructed in view of Kim, Chapple-Sokol, and Doyle, has a groove (with a quantum wire) formed in a top portion of the mesa.

21. In reference to claim 9, the transistor of Kizuki constructed in view of Kim, Chapple-Sokol, and Doyle, has a channel formed of a quantum wire which extends between source and drain electrodes (figures 17(a) and 17(b) of Kizuki). Kizuki discloses that a quantum dot is produced in the channel (column 3, lines 4-7) or along a region of the conducting means.

22. In reference to claim 10, Kizuki discloses that applying a voltage to the at least one further electrode (labeled "Gate 1" in figures 17(a) and 17(b)) helps to provide confinement for the quantum dot (column 3, lines 4-7).

23. So far as understood in claim 12, Kizuki discloses that applying a voltage to the at least one further electrode (labeled "Gate 1" in figures 17(a) and 17(b)) and additional electrode (labeled "Gate 1" in figures 17(a) and 17(b)) provides confinement for the quantum dot (column 3, lines 4-7) thereby meeting the limitation where the electrodes "provide confinement in a third dimension for charge carriers within the conducting means, in which hard confinement in two dimensions holds charge carriers within the conducting means."

24. So far as understood in claim 13, the transistor of Kizuki constructed in view of Kim, Chapple-Sokol, and Doyle, has a channel formed of a quantum wire which extends between source and drain electrodes (figures 17(a) and 17(b) of Kizuki). Figure 1D of Kizuki shows that the at least one further electrode (labeled "Gate 1" in figures 17(a) and 17(b)) and additional

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electrode (labeled "Gate 1" in figures 17(a) and 17(b)) are transverse to the channel or quantum wire or conducting means.

25. In reference to claim 14, the device of Kizuki constructed in view of Kim, Chapple-Sokol, and Doyle has electrodes which are capable of causing a peak within the energy bands of the first semiconductor (17) of the quantum wire or conducting means.

26. In reference to claim 15, figure 1D of Kim shows that the conducting means has a crescent shaped cross section (17).

Allowable Subject Matter

27. Claim 11 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

28. The following is a statement of reasons for the indication of allowable subject matter: the examiner is unaware of a quantum field effect transistor with a quantum wire formed of a GaAs core surrounded by AlGaAs where there is a plurality of quantum dots formed along the wire.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (703) 306-5688. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (703) 308-6601. The fax phone numbers for the

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organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

KVQ

August 26, 2002

NATHAN J. FLYNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

